Section 10 Direct Take Permit Application

A TITLE: Application for a Permit for Scientific Purposes Under the Endangered Species Act of 1973. ***(Two Studies Using Boat Electrofishing Gear. Study 1: Warmwater Fish Species Population Monitoring Through Standardized Sampling Methodology; and Study 2: Monitoring and Evaluation of Fish Predation on Listed Juvenile Chinook Salmon in the Lake Washington Basin).***

B SPECIES:

Study 1: Take authorization is requested for:
Chinook salmon, *Oncorhynchus tshawytscha*, of the following ESUs:
Puget Sound ESU listed as "threatened" on March 24, 1999 (64 FR 14308);
Snake River Spring/Summer-run ESU listed as "threatened" on April 22, 1992 (78 FR 14653);
Snake River Fall-run ESU listed as "threatened" on April 22, 1992 (78 FR 14653);
Lower Columbia River ESU listed as "threatened" on March 24, 1999 (64 FR 14308); and
Upper Columbia River Spring-run ESU listed as "endangered" on March 24, 1999 (64 FR 14308).

Chum salmon, *Onchorhynchus keta*, of the Columbia River listed as "threatened" on June 28, 2005 (70 FR 37160).

Coho salmon, *Oncorhynchus kisutch*, of the Lower Columbia River ESU listed as "threatened" on June 28, 2005 (70 FR 37160).

Sockeye salmon, *O. nerka*, of the Snake River ESU listed as "endangered" on November 20, 1991 (56 FR 58619).

Steelhead, *O. mykiss*, of the following ESUs:
Puget Sound DPS proposed for listing as "threatened" on March 29, 2006 (71 FR 15666)
Lower Columbia River ESU listed as "threatened" on March 19, 1998 (63 FR 13347);
Middle Columbia River ESU listed as "threatened" on March 25, 1999 (64 FR 14517);
Upper Columbia River ESU listed as "threatened" on January 5, 2006 (71 FR 834); and
Snake River Basin ESU listed as "threatened" on August 18, 1997 (62 FR 43937).

Study 2: Take authorization is requested for:
Puget Sound Chinook ESU listed as "threatened" on March 24, 1999 (64 FR 14308)
Puget Sound Steelhead DPS proposed for listing as "threatened" on March 29, 2006 (71 FR 15666)

C DATE: March 6, 2007

D APPLICANT:

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Study 2 Olympia contact: **Jim Scott, Science Division**
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E PERSONNEL INFORMATION:

Study 1:

1. Other personnel: Following are names, positions, and years of experience of WDFW employees responsible for managing fish population sampling and monitoring. These employees have education, training, and work experience in boat electrofishing operations, standardized sampling methodology, and fish handling procedures.

Region 1: Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, and Whitman counties.

John Whalen, Principal Investigator, 17 years professional biologist experience
Bill Baker, Field Supervisor, 2 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Marc Divens, Field Supervisor, 10 years professional biologist experience
Chris Donley, Field Supervisor, 10 years professional biologist experience
Jason McLellan, Field Supervisor, 7 years professional biologist experience
Glen Mendel, Field Supervisor, 22 years professional biologist experience
Randall Osborne, Field Supervisor, 5 years professional biologist experience
Curt Vail, Field Supervisor, 30 years professional biologist experience

Region 2: Adams, Chelan, Douglas, Grant, and Okanogan counties.

Joe Miller, Principal Investigator, 10 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Dave Burgess, Field Supervisor, 6 years professional biologist experience
Tammy Gish, Field Supervisor, 6 years professional biologist experience
Bob Jateff, Field Supervisor, 4 years professional biologist experience
Jeff Korth, Field Supervisor, 18 years professional biologist experience
Marc Petersen, Field Supervisor, 12 years professional biologist experience
Matt Polacek, Field Supervisor, 6 years professional biologist experience
Rochelle Shipley, Field Supervisor, 3 years professional biologist experience
Katrina Simmons, Field Supervisor, 5 years professional biologist experience
Michael Schmuck, Field Supervisor, 4 years professional biologist experience
Kevin Vallincourt, Field Supervisor, 2 years professional biologist experience
Art Viola, Field Supervisor, 26 years professional biologist experience

Region 3: Benton, Franklin, Kittitas, and Yakima counties.

John Easterbrooks, Principal Investigator, 27 years professional biologist experience
Eric Anderson, Field Supervisor, 20 years professional biologist experience
Bill Baker, Field Supervisor, 2 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Jim Cummins, Field Supervisor, 35 years professional biologist experience
Marc Divans, Field Supervisor, 10 years professional biologist experience
Paul Hoffarth, Field Supervisor, 11 years professional biologist experience
Randall Osborne, Field Supervisor, 5 years professional biologist experience

Region 4: Island, King, San Juan, Skagit, Snohomish, and Whatcom counties.

Pat Frazier, Principal Investigator, 20 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Steve Caromile, Field Supervisor, 9 years professional biologist experience
Adam Couto, Field Supervisor, 5 years professional biologist experience
Mark Downen, Field Supervisor, 10 years professional biologist experience
Kirt Hughes, Field Supervisor, 10 years professional biologist experience
Chad Jackson, Field Supervisor, 10 years professional biologist experience

Region 5: Clark, Cowlitz, Klickitat, Lewis, Skamania, and Wahkiakum counties.

Craig Burley, Principal Investigator, 20 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Jim Byrne, Field Supervisor, 17 years professional biologist experience
Steve Caromile, Field Supervisor, 9 years professional biologist experience
Adam Couto, Field Supervisor, 5 years professional biologist experience
Wolf Dammers, Field Supervisor, 33 years professional biologist experience
Steve Gray, Field Supervisor, 8 years of professional biologist experience
Bob Lucas, Field Supervisor, 30 years professional biologist experience
John Weinheimer, Field Supervisor, 23 years professional biologist experience

Region 6: Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific, and Thurston counties.

Bill Freymond, Principle Investigator, 29 years professional biologist experience
Bruce Bolding, Field Supervisor, 20 years professional biologist experience
Steve Caromile, Field Supervisor, 9 years professional biologist experience
Dan Collins, Field Supervisor, 30 years professional biologist experience
Randy Cooper, Field Supervisor, 26 years professional biologist experience
Adam Couto, Field Supervisor, 5 years professional biologist experience
Rick Ereth, Field Supervisor, 13 years professional biologist experience
Mike Gross, Field Supervisor, 23 years professional biologist experience
Thom Johnson, Field Supervisor, 28 years professional biologist experience
David Low, Field Supervisor, 5 years professional biologist experience
Hal Michael, Field Supervisor, 29 years professional biologist experience
Roger Mosley, Field Supervisor, 32 years professional biologist experience
Larry Phillips, Field Supervisor, 8 years professional biologist experience
Mike Scharpf, Field Supervisor, 12 years professional biologist experience

2. Field personnel: All field biologists and scientific technicians work under the supervision of one or more of the personnel listed above.

3. Funding source: This project is funded by WDFW General Fund sources for fish management activities.

4. Contractors: No contractors will be used.

5. Further scientific study: No samples will be sent to other institutions.

6. Transport/holding personnel: No listed species will be held or transported.

Study 2:

1. Other personnel: Following are names, positions, and years of experience of WDFW employees responsible for managing fish population sampling and monitoring. These employees have education, training, and work experience in boat electrofishing operations, standardized sampling methodology, and fish handling procedures.

Roger Tabor, Fish Biologist, US Fish and Wildlife Service, 510 Desmond Drive, Suite 102, Lacey, Washington, 98503, 360-753-9541

Hans Berge, Fish Biologist, King County Department of Natural Resources, 201 South Jackson Street, Suite 600, Seattle, Washington, 98104-3855, 360-296-1964

Steve Foley, District Fish Biologist, WDFW Fish Management Division, 16018 Mill Creek Boulevard, Mill Creek, Washington, 98012-1296, 425-775-1311, ext 113

Chad Jackson, District Fish Biologist, WDFW Fish Management Division, 16018 Mill Creek Boulevard, Mill Creek, Washington, 98012-1296, 425-775-1311, ext 113

Steve Schroder, Research Scientist, WDFW Science Division, 600 Capitol Way N, Olympia, Washington, 98501-1091, 360-902-2751

2. Field Personnel: Region 4

Anthony Fritts, WDFW, Field Supervisor, 11 years professional biologist experience
Jason McLellan, WDFW, Field Supervisor, 9 years professional biologist experience
Chris Donley, WDFW, Field Supervisor, 12 years professional biologist experience
Kelly Kiyohara, WDFW, Field Supervisor, 3 years professional biologist experience
Clayton Kinsel, WDFW, Field Supervisor, 3 years professional biologist experience

3. Funding Source: This project is funded by WDFW General Fund sources for fish management activities.

4. Contractors: No contractors will be used.

5. Further scientific study: Samples and data will be shared with King County, USFWS, NOAA Fisheries and represented agents on the Cedar River Fish Advisory Committee.

6. Transport /holding personnel: No listed species will be held or transported.

F. PROJECT DESCRIPTION, PURPOSE, AND SIGNIFICANCE:

Study 1

1. Justification of the objectives: Boat electrofishing is a critical component of WDFW's standardized sampling methodology for warmwater fish species (Bonar and Bolding 2000), which in turn is extremely important in managing Washington's warmwater fisheries. Standardized sampling methodologies provide biologists with the ability to evaluate fish population changes over time by ensuring continuity with prior years' data, and determine

whether populations are functioning properly with regard to angler harvest, fishing regulations, species interactions, and management strategies.

Because each gear type has an inherent bias in both sizes and fish species sampled, standardized sampling of warmwater fish populations requires a combination of gear types to adequately sample warmwater fish populations. This combination of gill nets, fyke nets, littoral sampling, angling, and boat electrofishing gear is deployed randomly along the shorelines of lakes or streams where warmwater fish such as bass, perch, sunfish, catfish, and walleye are commonly found.

During warmwater fish population sampling, boat electrofishing gear may encounter listed fish species in the following waters:

Region 1: **Snake River- Snake River Fall-run Chinook ESU, Snake River Spring/Summer-run Chinook ESU, Snake River sockeye ESU, and Snake River Basin steelhead ESU.**
Grande Ronde River- Snake River Fall-run Chinook ESU, Snake River Spring/Summer-run Chinook ESU, and Snake River Basin steelhead ESU.
Walla Walla River- Middle Columbia River steelhead ESU.
Palouse River (up to falls)- Snake River Fall-run Chinook ESU, Snake River Spring/Summer-run Chinook ESU, Snake River sockeye ESU, and Snake River Basin steelhead ESU.
Bennington Lake- Middle Columbia River steelhead ESU.

Region 2: **Columbia River (from Chief Joseph Dam to Priest Rapids Dam)-**
Okanogan River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Methow River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Twisp River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Chewuch River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Entiat River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Wenatchee River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Lake Wenatchee- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Chelan River- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Crab Creek- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Trinidad Creek- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Moses Lake- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Banks Lake- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.
Potholes Reservoir- Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU.

Region 3: **Columbia River (from Priest Rapids Dam to Crow Butte)- Snake River Fall-run Chinook ESU, Snake River Spring/Summer-run Chinook ESU, Snake River sockeye ESU, Snake River Basin steelhead ESU, Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU, and Middle Columbia River steelhead ESU.**

Region 4: **Lake Washington- Puget Sound Chinook ESU.**
Lake Union- Puget Sound Chinook ESU.
Lake Sammamish- Puget Sound Chinook ESU.

Region 5: **Silver Lake (Cowlitz County)- Lower Columbia River steelhead ESU**
Vancouver Lake- Lower Columbia River Chinook ESU, Lower Columbia River coho ESU, Columbia River chum, and Lower Columbia steelhead ESU, and Columbia River chum ESU.

Rowland Lake- Lower Columbia River Chinook ESU, Lower Columbia River coho ESU, Columbia River chum, and Lower Columbia River steelhead ESU.
Mayfield Lake- Lower Columbia River Chinook ESU, Lower Columbia River coho, Columbia River chum and Lower Columbia River steelhead ESU.
Lower Columbia River (from Crow Butte to mouth)- Snake River Fall-run Chinook ESU, Snake River Spring/Summer-run Chinook ESU, Columbia River Chum ESU, Snake River sockeye ESU, Snake River Basin steelhead ESU, Upper Columbia River Spring-run Chinook ESU, Upper Columbia River steelhead ESU, Middle Columbia River steelhead ESU, Lower Columbia River Chinook ESU, Lower Columbia River coho ESU, Lower Columbia River steelhead ESU, and Columbia River chum ESU.

Region 6: **Long Lake (Kitsap County)- Puget Sound Chinook ESU.**
Black Lake (Thurston County)- Puget Sound Chinook ESU.
Hoop Lake (Pierce County)- Puget Sound Chinook ESU.

2. Response to a federal agency: This study does not respond to a Federal recommendation or requirement.

3. Broader significance: This study is part of WDFW's management process for warmwater species.

4. Other projects: This study is not similar to any other study.

5. Justification of take: Listed species will not be targeted in this study and every effort will be made to reduce impacts on them.

Study 2

1. Justification of the objectives: This study will monitor current levels of predation by trout and other fish predators on listed juvenile Cedar River Chinook. Monitoring will include collection of diet samples from predator species, including trout, estimation of predator species population sizes. WDFW will use this information for a baseline in order to evaluate potential effectiveness of alternative fishing regulations as a means of reducing predation on juvenile Chinook. Sampling should occur both when juvenile Chinook are present in the Cedar River (January – June) and during the current Cedar River trout fishery (summer).

2. **Response to a federal agency: This study does not respond to a Federal recommendation or requirement.**

3. **Broader significance: The results of this study, which may include recommendations to modify fishery regulations to reduce predation on juvenile Chinook, are expected to be applicable to other areas of Puget Sound where fish predation on listed juvenile Chinook is considered to limit recovery.**

4. **Other projects: Data from other WDFW and non-WDFW projects may be incorporated if the data meet study needs. For example, George Pess (NOAA Fisheries) is assessing recolonization of the Cedar River watershed above Landsburg Dam by PIT-tagged salmonid fishes including listed Cedar River Chinook, steelhead, coho, rainbow trout, and coastal cutthroat trout. The proposed study can detect PIT-tagged fish from the NOAA Fisheries study and therefore increase understanding of the habitats that salmonids spawned above the dam utilize to complete their life histories. Conversely, detection of PIT-tagged trout from this study above Landsburg Dam would better define the spatial extent of predator populations.**

Detection of tagged fish from this study and the NOAA Fisheries study can occur at permanent antenna stations located at the Ballard Locks, Landsburg Dam, upper Rock Creek (located above the dam) and at a station to be installed at the confluence of the Cedar River with Lake Washington. Detection of tagged *O. mykiss* and *O. clarkii* at the Ballard Locks would address the question of anadromy in these species.

5. Justification of take: Listed Cedar River Chinook will not be targeted in this study, and every effort will be made to reduce impacts on them. This study is intended to identify and enumerate fish predator populations and to examine their diets, which include Cedar River Chinook. Sampling methods other than boat electrofishing were considered and rejected. Snorkeling would be ineffective because it is necessary to capture fish in order to collect diet samples. Further, sampling will be done at night when trout move from diurnal hiding places into the thalweg to feed. Between darkness and turbidity, predator counts and collection would be inefficient. Additionally, high winter flows, darkness and cold water would create dangerous conditions for field staff. Seining was also considered and rejected. Nets would be effective only in low-flow areas of the river such as pools, not in the thalweg. We need to sample all habitat types in order to effectively estimate the predator population abundance. Further, seining is size selective, and we wish to sample a wide range of predator sizes. For these reasons we believe that boat electrofishing is the most effective and efficient method for conducting population estimates and collecting predator diet samples.

The basis for the estimated take of Cedar River Chinook is presented in Study 2 Attachment 3.

G PROJECT METHODOLOGY:

Study 1

1. **Proposed duration: The proposed sampling period related to this permit application is January 2007 through January 2011. Most warmwater fish populations are sampled in May, June, August, September, and October. Project surveys will continue throughout the foreseeable future.**

2. **Procedures and techniques: Methods will remain the same. Boat electrofishing gear has been used in WDFW warmwater stock assessment since 1978. Standard boat electrofishing gear consists of Smith-Root SR-16 or SR-18 electrofishing boats with 5.0 GPP pulsator units. The gear is fished using pulsed DC current at 3-4 amps power. This**

level of power must be used to stun warmwater fish, which are not stunned at lower levels, as are salmonids. Pulsator unit settings vary with water conductivity. Gear on the newer Smith-Root boats causes fewer injuries to fish than older models that used different waveforms or even AC currents. Immediate fish mortalities are rare; more often, fish may be injured which may lead to delayed mortality. Because they have more surface area exposed to the electrical current, larger fish are injured at a higher rate than smaller fish.

Several variables on a boat can affect output densities. For warmwater surveys, power standardization is generalized to attain a level of 3-4 amps. The GPP pulsator is set between 250-350 volts; a frequency of 120 Hz is usually needed to effectively sample warmwater fish, while sampling salmonids can be effective at lower frequencies like 30 Hz and 60 Hz.

Sampling is conducted at night in randomly selected shoreline sections about 400 m in length.

Additionally, specific time and site locations are selected at random as well, according to annual project needs.

a. Capture methods: While electrofishing, the boat is maneuvered through shallow water (less than 6 feet deep) with the pedal down intermittently for a total of 600 seconds or through the entire 400 m survey section, whichever comes first. As many fish as possible are netted and placed into an aerated live well. Fish are not anesthetized, but are quickly weighed, measured for length, and scales are taken from a subsample of warmwater fish. Fish immediately recover and are returned alive to the area from which they were netted. Listed species will be released immediately.

b. Tags used: No tags or marks will be used.

c. Drugs used: No drugs of any type are used.

d. Holding time: Fish will be held for 5 to 15 minutes in an aerated live well until they recover. Then fish are released back into the area of capture.

e. Number and type of samples taken: Sampling of listed species will be limited to length and weight prior to release.

3. **Potential for injury or mortality: Surveys are timed to minimize takes of salmonids. Surveys of warmwater fish in rivers are usually conducted in the backwater sloughs, oxbow lakes, and ponds, rather than in the main channel. Survey timing, warmer water temperatures, and limiting sampling to shallow shoreline sections greatly limits the number of resident and anadromous salmonids taken with boat electrofishing gear.**

4. **Estimated take: Estimates of anticipated take of listed fish species during these studies are summarized in Attachment 1.**

5. **Estimated mortalities: Take of listed fish species during warmwater fish surveys is anticipated to be very low because surveys target times and locations where there is low occurrence of listed species. Estimates of potential mortalities of listed fish species during these studies are summarized in Study 1, Attachment 2.**

6. **How estimates were derived: Take estimates remain based on limited information because the survey technique has been conducted sparingly, and most of these waters still have not been boat electrofished. In areas where boat electrofishing has been conducted, take estimates are still very low.**

Estimated level of salmonid injury caused by standardized warmwater boat electrofishing surveys is higher than that in McMichael et al.'s Yakima River study (1998). Injury rate for captured salmonids longer than 250 mm was estimated to be 27.7% in that study. McMichael et al. used different pulsator settings than those used by this study. They used a pulsator frequency setting of 30 Hz, a voltage of 450, and amperage of 7, while this study uses a pulsator frequency setting of 120 Hz, a voltage of 250-350 and amperage of 3-4. J. Johnson estimated salmonid capture injury rates for fish longer than 250 mm to be about 60% at boat electrofishing settings similar to those used during this study's warmwater surveys (Smith-Root, Inc., per. comm.). Johnson's studies measured higher peak power densities than those measured on WDFW boats at Silver Lake in 1999. This suggests that injury rates for salmonids longer than 250 mm would also be lower. Estimated mortality of listed species in Attachment 2 was based on injury levels of 60% for salmonids longer than 250 mm (adults) and 30% for fish smaller than 250 mm (juveniles).

Study 2

1. Proposed duration: The proposed sampling period related to this application is from January 2007 through August 3, 2011. More specifically, annual sampling will occur during January to June and mid-July to August 3 (prior to presence of returning adult Chinook).

2. **Procedures and techniques:**
    a. **Capture methods: Sampling during the period of January to June will be conducted at night at various sites in the mainstem Cedar River below Landsburg Dam using a drift boat outfitted with a Coffelt Mark XXII electrofishing unit set to about 400 volts and 3.5B4 amps CPS. Electroshocking will target larger fish such as adult trout more than juvenile Chinook since larger fish present more surface area to the current. Samplers are unlikely to see fish smaller than 150 mm in length on the surface of the water. If juvenile Chinook are seen while electrofishing, we will cease electrofishing that site. Any shocked juvenile Chinook will be netted, held in an aerated live well until the fish recover, and promptly released back into the Cedar River. Recent annual steelhead escapements in the Lake Washington basin (including the Cedar River watershed) have been very low (< 33) making it unlikely that we will encounter any adult steelhead during our project. However, if an adult steelhead is electroshocked we will cease electrofishing that site. The adult steelhead will be netted, held in an aerated live well until recovered and released. There is currently no method for differentiating juvenile steelhead from juvenile resident *O. mykiss* in the field. Size ranges for juvenile steelhead and resident *O. mykiss* are identical and we are not aware of any visual characteristics to accurately differentiate the two from one another. Recent WDFW smolt trapping data in the Cedar River indicates very low abundance of juvenile steelhead: total of 267 steelhead smolts leaving the Cedar River in 2006. Therefore, even though we will not be able to differentiate juvenile steelhead from resident *O. mykiss*, we do not expect to encounter many juvenile steelhead due to their low abundance relative to resident *O. mykiss*. Sampling during mid-July to August 3 will be conducted during the day. Based on Cedar River Chinook run-timing observations, we do not expect returning adult Chinook or adult steelhead to be present in the Cedar River during this time period. However, we will snorkel each sample site prior to electrofishing in order**

to confirm that no adult Chinook or adult steelhead are present. Electrofishing will not occur if returning adult Chinook or adult steelhead are present.

b. **Tags used: No listed fish will be tagged in this study.**

c. **Drugs used: No drugs will be used on listed fish in this study.**

d. **Holding time: We do not expect to capture juvenile Chinook. However, if any are captured, they will be held for 5 to 15 minutes in an aerated live well until they recover. They will then be released back into the area of capture.**

e. **Number and type of samples taken: Listed fish will not be sampled.**

3. **Potential for injury or mortality: As with any electrofishing sampling, injury or mortality to listed species may occur directly from the electrical field or indirectly from handling stress. McMichael et al. (1998) reported an average injury rate for WDFW's boat electrofishing methods of 1.2% for *O. mykiss* less than 250 mm in length and 27.7% for *O. mykiss* greater than 250 mm in length. Injuries were detected by X-rays and necropsies so these rates are therefore considered an absolute percent of injury (both severe and slight) and not merely a percent of more serious, externally visible injuries.**

   Experienced personnel in accordance with NMFS guidelines will perform boat electrofishing.

   Efforts will be made to minimize take of listed Cedar River Chinook. Sampling will not take place when returning adult Chinook occur in the Cedar River. We will snorkel each sampling site prior to electrofishing in order to confirm the absence of adult Chinook. Sampling will take place mainly in the thalweg and in the erosional side of pools to maximize encounters with trout and minimize encounters with juvenile Chinook. Side channels, shallow stream margins and the depostional side of pools, all sites where we expect juvenile Chinook to be concentrated, will be avoided. We expect that only about 2% of juvenile Chinook will be located in the thalweg (Roger Tabor, USFWS and Hans Berge, King County, pers. comm.). Samplers will avoid shocking over Chinook redds. All redds have been flagged and their locations have been recorded on GPS and entered into a GIS layer. When the boat approaches a redd, the gear will be turned off.

4. **Estimated take: Estimates of anticipated take of listed fish species during these studies are summarized in Study 2, Attachment 1.**

5. **Estimated mortalities: Estimates of potential mortalities of listed fish species during this study are summarized in Study 2, Attachment 2.**

6. **How estimates were derived: The approach to estimating take in this study is described in detail in Study 2, Attachment 3. Essentially, numbers of Cedar River Chinook fry and/or pre-smolts present in the sampled river sections were estimated each month based on 2006 escapement information and data from juvenile migrant traps in the Cedar River (Seiler et al. 2003). The numbers of Chinook juveniles present in the sampled river section that were likely to be shocked were estimated for each month as were the numbers of shocked juveniles that were likely to be killed. We assumed a mortality rate of 1.5% based on published electrofishing-induced injury rates (2%) for juvenile Spring Chinook (McMichael et al. 1998).**

H DESCRIPTION AND ESTIMATES OF TAKE:

Study 1

1. The following may be encountered during sampling:

Chinook salmon, *Oncorhynchus tshawytscha*, of the following ESUs:
Puget Sound ESU listed as "threatened" on March 24, 1999 (64 FR 14308);
Snake River Spring/Summer-run ESU listed as "threatened' on April 22, 1992 (78 FR 14653);
Snake River Fall-run ESU listed as "threatened" on April 22, 1992 (78 FR 14653);
Lower Columbia River ESU listed as "threatened" on March 24, 1999 (64 FR 14308); and
Upper Columbia River Spring-run ESU listed as "endangered" on March 24, 1999 (64 FR 14308).
Chum salmon, *Onchorhynchus keta*, of the Columbia River listed as "threatened" on June 28, 2005 (70 FR 37160).
Coho salmon, *Oncorhynchus kisutch*, Lower Columbia River ESU, listed as "threatened" on June 28, 2005 (70 FR 37160)
Sockeye salmon, *O. nerka*, of the Snake River ESU listed as "endangered" on November 20, 1991 (56 FR 58619).
Steelhead, *O. mykiss*, of the following ESUs:
Puget Sound Steelhead DPS proposed for listing as "threatened" on March 29, 2006 (71 FR 15666)
Lower Columbia River ESU listed as "threatened" on March 19, 1998 (63 FR 13347);
Middle Columbia River ESU listed as "threatened" on March 25, 1999 (64 FR 14517);
Upper Columbia River ESU listed as "threatened" on January 3, 2006 (71 FR 52104); and
Snake River Basin ESU listed as "threatened" on August 18, 1997 (62 FR 43937).

2. Sampling schedule:

Surveys target times and locations where there is low occurrence of listed species. River survey locations are randomly selected shortly before the survey from several potential 400 m sites.

3. Recent status and trends:

Table 1. Provides current estimated escapement (Columbia Basin Run Size estimates from *U.S. v Oregon* Technical Advisory Committee Report, 2005; Chinook estimates from B. Sanford, WDFW Chinook Species Specialist; Lower Columbia River coho estimate from J. Haymes, WDFW Coho Species Specialist) and ratings from WDFW 2002 SASI status reports.

Table 1. 2004 escapement estimates of ESA-listed fish by ESU.

ESU	2004 Escapement Estimates	SaSI Rating
Puget Sound Chinook	62,143	Depressed
Puget Sound Steelhead	22,388	Depressed
Snake River Spring/Summer Chinook	400	Depressed
Snake River Fall Chinook	19,927	Depressed
Lower Columbia River Chinook	49,018	Depressed
Upper Columbia River Spring Chinook	2,974	Depressed
Columbia River Chum	18552	Depressed
Lower Columbia River Coho	446,000 (hatchery+wild)	Depressed
Snake River Sockeye	113	Depressed
Lower Columbia River Steelhead	6,789	Depressed
Middle Columbia River Steelhead	5,410	Depressed

Upper Columbia River Steelhead	**4,923**	**Depressed**
Snake River Basin Steelhead	**21,891**	**Depressed**

Study 2.

1. The following may be encountered during sampling:
Chinook salmon, *Oncorhynchus tshawytscha*, from the following ESU:
Puget Sound ESU Chinook listed as threatened on March 24, 1999 (64 FR 14308).
Specifically, Cedar River Chinook (WDF et al. 1993 and WDFW 2003) may be encountered.
Steelhead, *O. Mykiss,* Puget Sound DPS proposed for listing as "threatened" on March 29, 2006 (71 FR 15666)

Sampling schedule: Sampling will be conducted three nights per month from January through June to collect data on: 1) the abundance, size distribution and species composition of fish predators throughout the period when juvenile Chinook are present in the Cedar River. Sampling throughout the juvenile Chinook residence time in the Cedar should provide the best estimates of total predation on Chinook. We will also sample during mid-July to August 3 to estimate the population size of the Cedar River trout population during the summer catch and release trout fishery. We need to know if the numbers of predators present during the summer trout fishery differ from the numbers present when juvenile Chinook are in the river. Sampling during mid-July to August 3 coincides with a period of Chinook salmon absence in the Cedar River. By mid-July, all juvenile Chinook have emigrated (Seiler et al. 2003) and returning adult Chinook are not yet present. Therefore, we expect no take or mortality of adult or juvenile Chinook during this time period. We will snorkel prior to electrofishing to confirm returning Chinook adult absence. We will not electrofish if adult Chinook or juvenile Chinook are observed.

3. Recent status and trends: Table 1. Provides most recent 20 years' escapement estimates for Cedar River Chinook and the 1992 and 2002 SaSI status ratings (WDF et al. 1993 and WDFW 2003).

Table 1. Escapement estimates for Cedar River Chinook from 1975-2006 (data from the WDFW SaSI database and Steve Foley, WDFW Lake Washington District Biologist)

Year	Escapement Estimate	Year	Escapement Estimate	SaSI Rating
1975	656	1991	508	
1976	416	1992	525	
1977	675	1993	156	Depressed
1978	890	1994	452	
1979	1,243	1995	681	
1980	1,360	1996	303	
1981	624	1997	227	
1982	763	1998	432	
1983	788	1999	241	
1984	898	2000	120	
1985	766	2001	810	
1986	942	2002	369	
1987	1,540	2003	562	Depressed
1988	559	2004	587	
1989	558	2005	525	
1990	469	2006	550*	

***Preliminary estimate**

I TRANSPORTATION AND HOLDING:

Study 1

1. **Transportation: No listed species will be transported during the course of this study. All fish captured will be released in the same area they were captured.**

2. **Holding: Listed species will be held no longer than a few minutes to collect length and width data, recover, and then released.**

2. **Emergency contingencies: Fish are held for only a few minutes at the point of capture. A battery-powered aerator will be used to oxygenate the water and fresh river water will be available within a few feet.**

Study 2

1. **Transportation: No listed species will be transported during the course of this study. Any juvenile Chinook captured will be released in the same area where they were captured. Any capture of juvenile Chinook will be documented.**

2. Holding: If any listed species should be captured, they will be held no longer than 15 minutes to permit recovery from electroshocking.

3. Emergency contingencies: In the unlikely event of juvenile Chinook capture, they will be held for only a few minutes in order to permit recovery at the point of capture. A battery-powered aerator will be used to oxygenate the water in a live well, and fresh river water will be available within a few feet.

J COOPERATIVE BREEDING PROGRAM:

Study 1 and Study 2

The agency will participate and contribute data to a cooperative breeding program if requested.

K PREVIOUS OR CONCURRENT ACTIVITIES INVOLVING LISTED SPECIES:

Study 1

1. Previous permits:

Section 10 #1345 Direct Take Permit – Washington Department of Fish & Wildlife
Warmwater Fish Species Population Monitoring Through Standardized Sampling Methodology

2. Mortality events: None to date

Study 2

1. Previous permits:

Section 10 #1309 Direct Take Permit – King County Department of Natural Resources

2. Mortality events: None known

CERTIFICATION:

I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973 (ESA) and regulations promulgated there under,

and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA.

Paul Seidel, Fish Management Division Manager	Date

REFERENCES

Bonar, S.A. and B.D. Bolding. 2000. Standard fish sampling guidelines for Washington State ponds and lakes. Washington Department of Fish and Wildlife Report FPT00-28.

McMichael, G.A., A.L. Fritts, and T.L. Pearsons. 1998. Electrofishing injury to stream salmonids; injury assessment at the sample, reach, and stream scales. North American Journal of Fisheries Management 18:894-904.

Seiler, D. G. Volkhardt and L. Kishimoto. 2003. Evaluation of downstream migrant salmon production in 1999 and 2003 from three Lake Washington tributaries: Cedar River, Bear Creek and Issaquah Creek. Washington Department of Fish and Wildlife Report FPA 02-07.

U.S. v. Oregon Technical Advisory Committee Report. 2005. Biological Assessment of Incidental Impacts on Salmon Species Listed Under the Endangered Species Act in the 2005-2007 Non-Indian and Treaty Indian Fisheries in the Columbia River Basin.

WDF (Washington Dept. of Fish and Wildlife), Washington Dept. of Wildlife and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. WDF. Olympia, WA.

WDFW (Washington Dept of Fish and Wildlife). 2003. SaSI 2002. WDFW. Olympia, WA. Available on-line at http://wdfw.wa.gov/fish/sasi/.

Study 1. Warmwater Fish Species Population Monitoring Through Standardized Sampling Methodology

Attachment 1. Estimated annual take of listed fish species associated with statewide warmwater population monitoring

Species and ESU	Number of Individuals	Life Stage*	Sex	Origin	Take Activity Category	Location	Date
Puget Sound Chinook	4	Adult	NA	Wild	Stun, net, and release	Puget Sound	June-Oct
Snake River Spring/Summer Chinook	1	Adult	NA	Wild	Stun, net, and release	Snake River	June-Oct
Upper Columbia River Spring Chinook	1	Adult	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	1	Adult	NA	Adipose fin clip H	Stun, net, and release		
	1	Adult	NA	Non-clipped listed H	Stun, net, and release		
Middle Columbia River Steelhead	7	Adult	NA	Wild	Stun, net, and release	Middle Columbia River	June-Oct
Upper Columbia River Steelhead	1	Adult	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	1	Adult	NA	Adipose fin clip H	Stun, net, and release		
	1	Adult	NA	Non-clipped listed H	Stun, net, and release		
Snake River Basin Steelhead	1	Adult	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct
Puget Sound Chinook	100	Juvenile	NA	Wild	Stun, net, and release	Puget Sound	June-Oct
Snake River Spring/Summer Chinook	2	Juvenile	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct
	2	Juvenile	NA	Adipose fin clip H	Stun, net, and release		June-Oct
	2	Juvenile	NA	Non-clipped listed H	Stun, net, and release		June-Oct
Upper Columbia River Spring Chinook	4	Juvenile	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	3	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	3	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Middle Columbia River Steelhead	114	Juvenile	NA	Wild	Stun, net, and release	Middle Columbia River	June-Oct
Upper Columbia River Steelhead	2	Juvenile	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	1	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	1	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Snake River Basin Steelhead	3	Juvenile	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct

*Adults defined as longer than 250mm/Juveniles smaller than 250mm

Study 1. Warmwater Fish Species Population Monitoring Through Standardized Sampling Methodology

Attachment 2. Estimated mortalities of listed fish species associated with statewide warmwater population monitoring

Species and ESU	Number of Individuals	Life Stage*	Sex	Origin	Take Activity Category	Location	Date
Puget Sound Chinook	0	Adult	NA	Wild	Stun, net, and release	Puget Sound	June-Oct
Snake River Spring/Summer Chinook	0	Adult	NA	Wild	Stun, net, and release	Snake River	June-Oct
Upper Columbia River Spring Chinook	0	Adult	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	0	Adult	NA	Adipose fin clip H	Stun, net, and release		
	0	Adult	NA	Non-clipped listed H	Stun, net, and release		
Middle Columbia River Steelhead	0	Adult	NA	Wild	Stun, net, and release	Middle Columbia River	June-Oct
Upper Columbia River Steelhead	0	Adult	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	0	Adult	NA	Adipose fin clip H	Stun, net, and release		
	0	Adult	NA	Non-clipped listed H	Stun, net, and release		
Snake River Basin Steelhead	0	Adult	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct
Puget Sound Chinook	5	Juvenile	NA	Wild	Stun, net, and release	Puget Sound	June-Oct
Snake River Spring/Summer Chinook	0	Juvenile	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct
	0	Juvenile	NA	Adipose fin clip H	Stun, net, and release		June-Oct
	0	Juvenile	NA	Non-clipped listed H	Stun, net, and release		June-Oct
Upper Columbia River Spring Chinook	0	Juvenile	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	3	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	3	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Middle Columbia River Steelhead	4	Juvenile	NA	Wild	Stun, net, and release	Middle Columbia River	June-Oct
Upper Columbia River Steelhead	0	Juvenile	NA	Wild	Stun, net, and release	Upper Columbia River	June-Oct
	0	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	0	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Snake River Basin Steelhead	0	Juvenile	NA	Wild	Stun, net, and release	Snake River Basin	June-Oct

*Adults defined as longer than 250mm/Juveniles smaller than 250mm.

Study 2. Monitoring and Evaluation of Fish Predation on Listed Juvenile Chinook Salmon in the Lake Washington Basin

Attachment 1. Estimated annual take of listed fish species associated with monitoring and evaluation of fish predation on listed juvenile Chinook salmon in the Lake Washington Basin and Puget Sound steelhead proposed for listing.
See Study 2, Attachment 3 for details.

Species and ESU	Number of Individuals	Life Stage	Sex	Origin	Take Activity Category	Location	Date
Puget Sound Chinook	0	Adult	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
	0	Adult	NA	Adipose fin clip H	Stun, net, and release		
	0	Adult	NA	Non-clipped listed H	Stun, net, and release		
Puget Sound Chinook	8760	Juvenile	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
	0	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	0	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Puget Sound Steelhead	<1	Adult	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
Puget Sound Steelhead	<1	Juvenile	NA	Wild	Stun, net, and release	Puget Sound (Cedar River	Jan 1-Aug 3

Attachment 2. Estimated annual mortalities of listed fish species associated with monitoring and evaluation of fish predation on listed juvenile Chinook salmon in the Lake Washington Basin and Puget Sound steelhead proposed for listing.
See Study 2, Attachment 3 for details.

Species and ESU	Number of Individuals	Life Stage	Sex	Origin	Take Activity Category	Location	Date
Puget Sound Chinook	0	Adult	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
	0	Adult	NA	Adipose fin clip H	Stun, net, and release		
	0	Adult	NA	Non-clipped listed H	Stun, net, and release		
Puget Sound Chinook	130	Juvenile	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
	0	Juvenile	NA	Adipose fin clip H	Stun, net, and release		
	0	Juvenile	NA	Non-clipped listed H	Stun, net, and release		
Puget Sound Steelhead	0	Adult	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3
Puget Sound Steelhead	0	Juvenile	NA	Wild	Stun, net, and release	Puget Sound (Cedar River)	Jan 1-Aug 3

Study 2. **Monitoring and Evaluation of Fish Predation on Listed Juvenile Chinook Salmon in the Lake Washington Basin**
Attachment 3.
Below is the logic for the estimated take and indirect mortality for listed Cedar River Chinook from January – June 2007.

Take = number of juvenile Cedar River Chinook electroshocked in the study.
Mortality = juvenile Cedar River Chinook killed as a result of electroshocking; assumed to be 1.5% of shocked juvenile Chinook (based on McMichael et al. 1998 results for juvenile spring Chinook exposed to electrofishing).

Sampled area: 6 RM (6 non-contiguous 1-mile sections). For trout population estimates in February and May, each of the 6 sections will be sampled twice, once for marking and again for recapture. In January, March, April and June each section will be sampled only once in order to estimate predation levels.

January take and indirect mortality
Most juveniles would not yet have hatched. We assumed that the take would be 5% of the February take estimate.

February take = 3,840
January take = 3,840 x 0.05 = **192**
January mortality = 20% of February take or 192 x 0.015 = **2**

February take and indirect mortality
We assumed that all fry would have emerged from the gravel by mid-February. A total of 550 redds was counted below Landsburg Dam in 2006 (Hans Berge, King County, personal communication). The number of redds was assumed to equal the number of female Chinook spawners (Seiler et al. 2003).

Analysis of juvenile trap data produced an estimate of 450 migrants per female = 450 migrants/female x 550 females = 247,500 migrants. On average, 75% of Cedar River Chinook captured in the downstream juvenile traps are fry and about 25% are presmolts (Seiler et al. 2003).

These percentages translate into a fry estimate for 2007 of 247,500 x 0.75 =185,625 (~180,000) and a 2007 pre-smolt estimate of 247,500 x 0.25 = 61,875 (~62,000).

We assumed that about half the Cedar River Chinook juveniles would migrate as fry and half as pre-smolts. By doubling the fry estimate of ~180,000, we estimate that the number of Chinook fry in the river in February was 360,000. Note that these estimated percentages of fry and pre-smolt migrants are not in conflict with the percentages of fry (75%) and pre-smolts (25%) captured in juvenile traps.

Assuming uniform distribution in the river, there should be about 16,000 fry per mile (360,000 total fry/22.5 river miles from Landsburg to the mouth of the Cedar). We assumed that only 2% of fry would be susceptible to electroshocking in the thalweg (Roger Tabor, USFWS and Hans Berge, King County, pers. comm.) because at night most fry are expected to move to shallow river margins and because of their small surface area. This yields 16,000 x 0.20 = 320 “shockable” juveniles per mile.

In February the six miles sampled would be sampled twice (mark and recapture) for a total of 12 miles shocked. This yields a **February take** of 320 juveniles/mi x 12 miles = **3,840** juvenile Chinook shocked.

Only 1.5% of electroshocked fish of this size are expected to die for a **February** indirect **mortality** of 3,840 x 0.015 = **57**

March take and indirect mortality

We expect that 25% of the original fry will remain in river by mid-March (Seiler et al. 2003) and all of the ~62,000 pre-smolt migrants for a total of 120,000 juveniles.
120,000 juveniles/22.5 miles = 5,333 juveniles/mile
Shockability increases as growth occurs to 5%
5,333 juveniles/mile x 0.05 = 267 juveniles shocked/mile
267 shockable juveniles/mile x 6 mi shocked = 1,602 juveniles shocked (**take**)
1,602 juveniles shocked x 0.015 mortality = 24 juveniles dead

April take and indirect mortality

We assume that 120,000 juveniles will have remained in the river (Seiler et al. 2003) but that mortality on the estimated 62,000 pre-smolts will be about 66%, for a total of 80,000 juveniles
80,000 juveniles/22.5 mi = 3,556 juveniles/mi
Shockability increases to 10%
3,556 juveniles/mi x 0.10 = 356 juveniles shocked/mi
356 juveniles shocked/mi x 6 mi = 2136 juveniles shocked (take)
2136 juveniles shocked x 0.015 mortality = 32 juveniles dead

May take and indirect mortality

All juveniles migrating as fry are expected to have left the river by May, leaving about 62,000 pre-smolts
62,000 pre-smolts/22.5 mi = 2,756 pre=smolts/mi
Shockability remains at 10%
2,756 pre-smolts/mi x 0.10 = 276 pre-smolts shocked/mi
However, only 20% of the potentially shockable pre-smolts are expected to remain in the thalweg where they are susceptible to shocking
276 pre-smolts shocked/mi x 0.20 = 55 pre-smolts shocked/mi
55 pre-smolts shocked/mi x 12 miles shocked = 660 pre-smolts shocked (**take**)
660 pre-smolts x 0.015 mortality = 10 pre-smolts dead

June take and indirect mortality

Migration by both fry and pre-smolts is nearly complete by mid-June (Seiler et al. 2003). The estimates for take and mortality are half those in May.
Pre-smolts shocked = 660/2 = 330 (**take**)
Pre-smolts killed = 10/2 = 5

January – June take and indirect mortality:

Total take = 192 + 3,840 + 1,602 + 2,136 + 660 + 330 = **8,760**
Total indirect mortality = 2 + 57 + 24 + 32 + 10 + 5 = **130**

Hans B. Berge

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EXPERIENCE

KING COUNTY DEPARTMENT OF NATURAL RESOURCES
WATER AND LAND RESOURCES DIVISION
WATER RESOURCES MONITORING GROUP
7-99 TO PRESENT

AGRICULTURAL DRAINAGE ASSISTANCE PROGRAM ("FISH AND DITCH PROGRAM")

Developed Aquatic Monitoring Plan and protocol for Agricultural Drainage Maintenance Program, and wrote annual Monitoring Reports. Implemented and modified current BMPs to better enhance fish habitat as mitigation for ditch dredging. Worked with farmers, environmentalists, state agencies, and tribes to acquire necessary permits and mitigation efforts to satisfy all interests. Worked with engineers, wetland scientists, and other fisheries biologists to approach projects from a multi-disciplinary perspective. Responsible for data collection, training personnel in fisheries sampling, water quality sampling strategies and equipment, macroinvertebrate surveys, securing permits, and summarizing data. Published reports for public review on the King County website. Presented data to fisheries professionals at the 2001 Annual Meeting of the American Fisheries Society.

AQUATIC HABITAT INVENTORY ASSESSMENT

Assisted in the planning of aquatic habitat inventories of the Northern Tributaries of Lake Washington, and co-authored summary report. Developed a new multi-metric index to categorize stream habitat quality in Puget Sound lowland streams. Assisted in the development of King County Habitat Inventory Protocols, and trained current King County personnel in habitat inventory protocols and the use of field instruments such as GPS technologies and survey equipment. Trained King County personnel in analytical methods to understand data collected in habitat inventories.

BULL TROUT PROGRAM

Implemented a bull trout reconnaissance effort to determine historical and current use of native char in King County. Responsibilities include study design, training personnel in snorkeling and fish identification, habitat surveys, assessing existing databases, analysis of data, writing a report, compiling a GIS database, working with other collaborating agencies, consulting firms, and non-governmental organizations. Published final report for the World Wide Web. Presented data to fisheries professionals at the 2001 Annual Meeting of the American Fisheries Society.

CHINOOK AND KOKANEE SALMON STUDIES IN WRIA 8

Coordinated and developed a study to document the spatial and temporal spawning of adult salmonids in WRIA 8. Secured funding for 2001, 2002, and 2003 studies with collaboration from SPU, WDFW, and the Muckelshoot Indian Tribe. Carried out GSI studies and used both allozymes and micro-satellite techniques to distinguish population characteristics of chinook salmon in the Lake Washington Watershed. Trained King County staff in similar work with kokanee in 2000. Responsible for presenting findings to the Kokanee Technical Committee, the King Conservation District (funding agency), and the Instream Flow Committee (IFC), Anadromous Fish Committee (AFC), and the WRIA 8 Technical Committee. Responsible for writing annual reportsup kokanee data collected by King County Staff in 1998, 1999, and 2000. Member of Kokanee

Technical Committee, and alternate for IFC and AFC.

SALMON WATCHER PROGRAM

Trained volunteers in fish identification, and salmonid ecology. Provided technical information to project lead on fisheries and related aquatic ecology. Volunteers in this program collect pertinent fisheries data (population and distribution) of spawning steelhead, trout, and salmon in areas throughout King County. Prepared a slide show outlining salmonid ecology, including an ID quiz, for the training program and put this information on the King County Salmon Watcher website. Throughout 2000 and 2001, I have answered questions from volunteers on salmonid ecology and identification. I bring a technical perspective to an otherwise non-technical program. Presented data to fisheries biologists at the Western Division of the American Fisheries Society annual meeting in 2000, and won an award for Best Professional Poster at that meeting.

USDA FOREST SERVICE
FISH ECOLOGY UNIT (FEU)/FISH HABITAT RELATIONSHIPS UNIT
5-94 to 7-99
FISHERIES BIOLOGIST

Assisted researchers and managers in fisheries projects dealing with cold water fish (salmonids) throughout Utah, Idaho, and Wyoming. Primary field duties included supervising and training personnel in aquatic habitat inventory and fisheries sampling. Specific expertise in fisheries sampling methodology, fish tagging techniques (including PIT and telemetry tagging), genetic sampling techniques, macroinvertebrate sampling, mapping streams, design and construction of fish habitat structures, and classifying current and potential fish habitat. Non-field duties included data synthesis, database management, report writing, and Section 7 ESA Consultations. Specific expertise with ESA listed species including bull trout, chinook salmon, and endangered Colorado River fishes.

ASSISTANT PROJECT LEADER/HEAD FIELD BIOLOGIST

Green River Cutthroat Trout Assessment Project, in cooperation with the Bureau of Reclamation (BOR), Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM) and Utah Department of Wildlife Resources (UDWR), 1997-1999. Designed a research project identifying limiting factors of Colorado River cutthroat trout in a tailwater fishery in Northeastern Utah. Trained and supervised personnel from the BLM Aquatic Monitoring Center and the UDWR in electrofishing, stomach pumping, anesthetizing fish, and recording pertinent fisheries data. Responsible for study design, field operations, and senior author on a summary report of this study. A manuscript of this work has been submitted to the Transactions of the American Fisheries Society for publication.

ASSISTANT PROJECT LEADER/TRAINING COORDINATOR

Pilot Steelhead/Bull Trout Habitat and Riparian Monitoring Project in Central Idaho, 1998 and 1999. Assisted the director of the FEU in training field crews in measuring physical and biological parameters of stream reaches and riparian transects, and the use of equipment and protocols. Helped establish parameters for future monitoring plans in the Interior Columbia River Basin. Responsible for working under a set budget and predicting budgets for similar projects to be completed in basins in Oregon and Washington.

EDUCATION

UNIVERSITY OF WASHINGTON

M.S. Fisheries to be completed March 2007

UTAH STATE UNIVERSITY

B.S. Fisheries and Wildlife with an emphasis in Fisheries Management

SKILLS

- ArcView/ArcInfo GIS Software
- Windows 2000/NT
- Word processing (WordPerfect and MS Word)
- Spreadsheets (Excel, Quattro Pro)
- Statistical software (SPSS, SAS, DataDesk and Statistica)
- Presentation Packages and Graphic Software (Power Point and PhotoShop).
- Member of Salvelinus confluentus Curiosity Society
- Officer in North Pacific International Chapter of the American Fisheries Society (AFS)
- Certified Fisheries Professional American Fisheries Society
- Member of AFS Bull Trout Committee
- Recipient of "Best Poster" award at Western Division AFS Meeting in Telluride, Colorado (July 2000)
- Completion of AFS Statistics Course (August 2000)
- Completion of King County Advanced ESA Course (June 2001)
- Eagle Scout

Steve Foley
Fisheries Biologist
Fish Program
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16018 Mill Creek Blvd
Mill Creek, WA 98012-1296
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foleysrf@dfw.wa.gov

Current Responsibilities:
Anadromous fish biologist primarily responsible for stock assessment of the anadromous salmonids in the Lake Washington Watershed.

Expertise:
Twenty-three years as a fisheries biologist, primarily focused on salmon and steelhead management and stock assessment. Utilized numerous collection methods to assess salmonid populations including backpack electro-shockers to sample juvenile salmonids in streams and boat shockers to collect fish from lakes. In addition to eletrofishing equipment, collected adults and juveniles using seines, traps, hook and line, and gill nets.

Chad Stephen Jackson
District 13 Fish Biologist
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Current Responsibilities:
Lead agency fish biologist for Northern King, Snohomish, and Island Counties.

Expertise:
Thirteen years experience performing stream and lake fish community sampling with boat and backpack electrofishing equipment. Twelve years experience handling and identifying fish species. Eight years experience as a professional biologist supervising fish sampling crews.

Steven L. SCHRODER
Fisheries Research Scientist, Leader Ecological Investigations Unit
Science Division, Fish Program, Washington Department of Fish and Wildlife
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Education

Ph.D. Fisheries, University of Washington 1981
M.S. Fisheries, University of Washington 1973
B.S. Fisheries, University of Washington 1969

Positions Held

Fisheries Research Scientist II, 1990 – present, Washington Department of Fish and Wildlife
Fisheries Research Scientist I, 1981 – 1990, Washington Department of Fisheries
Fisheries Biologist III, 1980 – 1981, Fisheries Research Institute, University of Washington
Predoctoral Research Associate 1973-1981, Fisheries Research Institute, University of Washington
Research Assistant, 1971 –1973, Fisheries Research Institute, University of Washington
Fisheries Technician, 1971, Fisheries Research Institute, University of Washington

Expertise

a) Reproductive ecology of salmonid fishes
b) Artificial production of salmonids in hatcheries and spawning channels, evaluating domestication effects on cultured salmonids, recovering, monitoring and evaluating the success of salmonid supplementation programs
c) Developing alternative methods of mass marking juvenile fishes, including embryos

Selected Recent Publications

Berejikian, B.A., E.P. Tezak, L. Park, E. LaHood, S.L. Schroder, and E. Beall. 2001. Male competition and breeding success in captively reared and wild coho salmon (*Oncorhnchus kisutch*). Can. J. Fish. Aquat. Sci. 58: 804-810.

Berejikian, B.A., E.P. Tezak, and S.L. Schroder. 2001. Reproductive behavior and breeding success of captively reared chinook salmon. North American Journal of Fisheries Management. 21:255-260.

Fresh, K.L., S.L. Schroder, and M.I. Carr. 2003. Predation by northern pikeminnow on hatchery and wild coho salmon smolts in the Chehalis River, Washington. North American Journal of Fisheries Management 23: 1257 – 1264.

Maynard, D.J., T.A. Flagg, C.V.W. Mahnken, and S.L. Schroder. 1996. Natural rearing technologies for increasing post release survival of hatchery-reared salmon. Bull. Natl. Res. Inst. Aquacult., Supple. 2:71-77.

Schroder, S.L., C.M. Knudsen, E.C. Volk. 1995. Marking salmon fry with strontium chloride solutions. Can. J. Fish. Aquat. Sci. 52:1141-1149.

Schroder, S.L., E.C. Volk, C.M. Knudsen, and J.J. Grimm. 1996. Marking embryonic and newly emerged salmonids by thermal events and rapid immersion in alkaline-earth salts. Bull. Natl. Res. Inst. Aquacult., Supple. 2:79-83.

Volk, E.C., A. Blakley and S.L. Schroder. 2000. Otolith chemistry reflects migratory characteristics of pacific salmonids: Using otolith core chemistry to distinguish maternal associations with sea and fresh waters. Proceedings of the second international symposium on otolith research and application, Bergen, Norway, June 1998. Fisheries Research 46: 251-266.

Volk, E.C., S.L. Schroder, and J.J. Grimm. 2005. Otolith thermal marking. Pages 447-463 *In* S.X. Cardin, K.D. Friedland, and J.R. Waldman (ed.s) Stock Identification Methods, Elsevier Press.

Roger Allen Tabor

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Education:

Utah State University; Logan, Utah; attended September 87 - June 90; M.S. in Fisheries and Wildlife Biology, graduated June 90**.**

Colorado State University; Ft. Collins, Colorado; attended September 76 - May 82; B.S. in Fishery Biology, graduated May 82.

Work Experience:

1. **Fishery Biologist**; U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington; November 91 - present; lead biologist for several projects on ecology of freshwater fishes including anadromous salmonids. Recent projects include: migratory behavior of Chinook salmon smolts, nearshore habitat use of juvenile Chinook salmon in lakes; predation of juvenile sockeye salmon and Chinook salmon by predatory fishes; distribution and habitat use of freshwater sculpin.

2. **Fishery Biologist**; U.S. Fish and Wildlife Service, Columbia River Field Station, Cook, Washington; April 90 - November 91; Biologist with research project on predation of juvenile salmonids by piscivorous fishes.

3. **Research Assistant**; Utah State University, Logan, Utah; May 87 - April 90; Involved with research project to understand mortality factors of juvenile rainbow trout in Utah reservoirs.

4. **Laboratory Technician**; Normandeau Associates, Inc., Portsmouth, New Hampshire; September 86 - January 87; sorted marcoinvertebrate samples and analyzed fish scales.

5. **Fish Culture Extension Agent**; Peace Corps, Zaire, Africa; September 82 - March 86; Extension agent for rural fish farmers in western Zaire.

6. **Foreign Fisheries Observer**, National Marine Fisheries Service, Seattle, Washington, June 82 - August 82; Collected biological data on catch of four South Korean stern trawlers near the Aleutian Islands.

7. **Fisheries Technician**, U.S. Forest Service, Anchorage, Alaska; May 81 - August 81; Involved with radio telemetry research project on movements of adult chinook salmon.

Peer reviewed articles:

Nowak, G.M., R.A.Tabor, E.J. Warner, K.L. Fresh, and T.P. Quinn. 2004. Ontogenetic shifts in habitat and diet of cutthroat trout in Lake Washington, Washington. North American Journal of Fisheries Management 24:624-635.

Poe, T.P, R.S. Shively, and R.A. Tabor. 1994. Ecological consequences of introduced piscivorous fishes in the lower Columbia and Snake rivers. Pages 347-360 *in* D.J. Stouder et al., editors. Theory and application in fish feeding ecology. University of South Carolina Press, Columbia.

Tabor, R.A., G.S. Brown, and V.T. Luiting. 2004. The effect of light intensity on sockeye salmon fry migratory behavior and predation by cottids in the Cedar River, Washington. North American Journal of Fisheries Management 24:128-145.

Tabor, R.A., K.L. Fresh, D.K. Paige, E.J. Warner, and R.J. Peters. 2006. Distribution and habitat use of cottids in the Lake Washington basin. American Fisheries Society Symposium 53:25-40.

Tabor, R.., C. Luecke, and W. Wurtsbaugh. 1996. Effects of *Daphnia* availability on growth and food consumption of rainbow trout in two Utah reservoirs. North American Journal of Fisheries Management 16:591-599.

Tabor, R.A., R.S. Shively, and T.P. Poe. 1993. Predation on juvenile salmonids by smallmouth bass and northern squawfish in the Columbia River near Richland, Washington. North American Journal of Fisheries Management 13:831-838.

Tabor, R.A., E. Warner, and S. Hager. 2001. An oriental weatherfish (*Misgurnus anguillicaudatus*) population established in Washington State. Northwest Science 75:72-76.

Tabor, R.A. and W.A. Wurtsbaugh. 1991. Predation risk and the importance of cover for juvenile rainbow trout in lentic systems. Transactions of the American Fisheries Society 120:728-738.

Other significant reports:

Tabor, R.A. 1990. The importance of cover for juvenile rainbow trout in lentic systems: field observations and experimental studies on predation. Master's thesis, Utah State University, Logan, Utah.

Tabor, R.A., M.T. Celedonia, F. Mejia, R.M. Piaskowski, D.L. Low, B. Footen, and L. Park. 2004. Predation of juvenile chinook salmon by predatory fishes in three areas of the Lake Washington basin. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

Tabor, R.A. and J. Chan. 1996. Predation on sockeye salmon fry by piscivorous fishes in the lower Cedar River and southern Lake Washington. U.S. Fish and Wildlife Service, Western Washington Fishery Resource Office, Olympia, Washington.

Tabor, R.A., J. Chan, and S. Hager. 1998. Predation on sockeye salmon fry by cottids and other predatory fishes in the Cedar River and southern Lake Washington, 1997. U.S. Fish and Wildlife Service, Western Washington Office, Lacey, Washington.

Tabor, R.A., B. Pfeifer, C. Whitmus, G. Maxwell, and E.E. Knudsen. 1994. Sonic tagging and tracking of wild winter steelhead at the Ballard Locks, Seattle, Washington, spring 1994. U.S. Fish and Wildlife Service, Western Washington Fishery Resource Office, Olympia, Washington.

Tabor, R.A., H.A. Gearns, C.M. McCoy III, and S. Camacho. 2006. Nearshore habitat use by juvenile Chinook salmon in lentic systems of the Lake Washington basin, annual report, 2003 and 2004. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

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Education: B.S. Fisheries and Wildlife from Michigan State University, 1997
M.S. Wildlife and Fisheries Science from Pennsylvania State Uiversity, 1999
Ph.D. Fisheries and Wildlife from Michigan State University, 2004

Recent Previous Employment: 2004-Present; Research Scientist,
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Current Responsibilities: Lead agency research scientist for developing the Cedar River Trout population dynamics research study and salmon-habitat productivity models for salmon and steelhead recovery planning. Supervises WDFW's Salmonid Stock Inventory (SaSI) program. Lead agency representative on the Pacific Salmon Commission's Chinook Technical Team. Responsible for evaluating existing salmon-habitat productivity models, developing new salmon-habitat productivity models, application of Ecosystem Diagnosis and Treatment (EDT) in the Western Washington, integration of salmon and steelhead populations in agency sponsored Ecoregion Conservation Planning.

Expertise: Ten years experience developing and implementing coldwater fisheries science research projects including salmonid population monitoring and modeling in the Pacific Northwest and Great Lakes regions. Ten years experience performing and supervising stream and lake fish community sampling with boat, backpack and tote-barge electrofishing equipment. Seven years experience modeling the relationships linking trout and salmon population performance to freshwater habitat quality and quantity. Specific areas of interest are: salmon and steelhead population dynamics, fish-habitat productivity modeling, fisheries exploitation rate analyses, fisheries management policy, and watershed and salmon recovery planning.